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B.t. Trials — 1978

Bacillus thuringiensis Berliner was used operationally and experimentally to control the spruce budworm in Maine, Quebec and Ontario.

In Maine, Thuricide 16B at 80oz/acre, 8 B.I.U. was applied to 21,848 acres using Bell G5 helicopters (5 with conventional nozzles and one with Becomist emission units). Prespray counts were 9-24 larvae/45 cm branch tip in the treated area and 18-30 larvae/45 cm branch tip in check areas. Fifty-five percent defoliation was expected in the treated area with 33 percent observed, and 71 percent defoliation was expected in the check area with 81 percent observed.

The Quebec Department of Lands and Forests tested three B.t. products (Thuricide, Dipel and Novobac) mixed with chitinase, a sticker, and two carriers (sorbitol and monosodium dihydrogen phosphate), formulations developed by the Laurentian Forest Research Centre. A total of 6000 acres were treated by DC6B (1 gal/acre) and 12,000 acres by Grumman AgCat (0.5 gal/acre). Problems were experienced in assessing the effects of the program owing to low population counts in some check plots. However, in the area treated with a DC6B (10-15 pre-spray larvae/45 cm branch tip), a total mortality of 97.6 percent was achieved and average defoliation limited to 30 percent. A good deposit of B.t. was recorded in the area. Results using the Grumman AgCat were variable.

The Laurentian Forest Research Centre, CFS, Quebec, tested formulations of Thuricide and Novobac on eight 40 hectare (100 acre) blocks. Application rate was 64 oz/acre, 6.8 B.I.U. using a Grumman AgCat. In treated blocks, residual populations were between 1.4 and 4.1

larvae/45 cm branch tip and final mortality rates between 80.6 and 91.7 percent. In check areas, residual populations were between 2.5 and 8.4 larvae/45 cm branch tip and final mortality rates between 40.0 and 71.4 percent. Loss of tree vitality (measured by the presence or absence of buds produced at the end of the growing season) was between 1.6 and 16.3 percent in treated blocks, and between 23.4 and 70 percent in check areas. A number of observers visited test blocks in 1978 and were impressed with the evident foliage protection.

In Ontario, 1000 acres were sprayed with Thuricide and Dipel at 0.5 gal/acre, 7.2 B.I.U. using a Cessna AgTruck. Good results were obtained on balsam fir (2-56 percent defoliation after spraying) with poor results recorded on white spruce.

Spruce Budworm Pheromone Trials Maritimes 1978

The pheromone trials conducted in New Brunswick and Nova Scotia against the spruce budworm in 1978 met with limited success. The objective was to test four concentrations (release rates of 0.1, 1.0, 10, and 20 mg of pheromone/ha/hr) using 100 ha test blocks in each province. The pheromone, consisting of a 96:4 trans-: cis-isomer blend was used in the Conrel hollow fiber formulation and applied by two Cessna aircraft. The planned quantity of pheromone was applied in New Brunswick about 9 days before female emergence. In Nova Scotia the highest application block, 20 mg, only received 65 percent of the proposed amount and application was terminated, for a number of reasons, 5 days before first female emergence.

The basic cause of the lack of success in suppressing mating and oviposition in the field population can largely be traced to the unexpected release rate characteristics of the formulation. Product specification and pretrial testing indicated a relatively constant rate but atmospheric monitoring of pheromone and successive measurements of residual pheromone in fibers by C. Weisner (New Brunswick Research and Productivity Council) and B. Lynch (St Francis-Xavier University), indicated a 70 to 80 percent loss within 10 days after application. Thus little pheromone was present when the bulk of the adult population was emerging and mating. Even so, A.W.A. Thomas (Maritimes Forest Research Centre) found that 15 to 20 percent of the females collected early in the season from trees treated with a chemical adulticide were unmated indicating a short-term effect shortly after application.

Mating suppression was also recorded among caged populations where varying densities of females, 1, 3 and 10, were placed with males in large screen cages suspended within the crown canopy of treatment blocks. J. Schmidt (University of New Brunswick) recorded as high as 60 percent reduction in mating on the X20 mg block (NB) early in the season. Combined data from Schmidt and Thomas for the whole season showed a 21 percent reduction in mating among caged females even though the pheromone level was low.

The highest level of success in the trials was achieved in disrupting the orientation of males (most active within the crown canopy) to pheromone sources at ground level. The pheromone sources included sticky traps baited with synthetic pheromone and 'tethered' virgin females.

Data from pheromone-baited traps indicated more than an 80 percent disruption while actual mating suppression based on tethered females ranged from 50 to 95 percent. It is suspected that this 'long-range' orientation would be analogous to a male seeking but failing to find a female with which to mate in a sparse population.

The technical committee in charge of program design and development concluded that the results of the trials support the concept that budworm mating suppression can be achieved by the application of synthetic pheromone even though the actual level of suppression and budworm control achieved in the trials was disappointingly low. Budworm control, or low egg counts in treatment blocks, could have been cancelled by invasion of fertile females but D.O. Greenbank (Maritimes Forest Research Centre) found no evidence of mass invasions. At this point it seems justifiable to conclude that the low level of mating suppression resulted from the initial high rate of loss of the pheromone followed by a low level of the residual during the moth-mating period. There is a general consensus within the technical committee that a formulation was applied in which the chemical and physical properties differed in a number of respects from sample fibers that were studied during the planning stages of the program.

There will be no large-scale field testing of pheromone in 1979. It is currently proposed that research and limited field testing continue on formulations, the control potential of different isomer blends, atmospheric monitoring, and the use of pheromone as a population monitoring tool.

UFOs

Time magazine in its November 20, 1978, issue reports that those UFOs reportedly sighted in Utah from 1965 to 1968 were probably migrating spruce budworm moths illuminated by St. Elmo's fire—a common atmospheric phenomenon that occurs where strong electrical fields are created by storm disturbances in an area. Two U.S. Department of Agriculture scientists, Philip S. Callahan and R.W. Mankin, offered this explanation of the UFOs in a report in *Applied Optics*.

Callahan and Mankin began their research after reading Frank B. Salisbury's 1974 book, *The Utah UFO Display*, and noting how similar were the movements of the UFOs and the actions of insect swarms. The two scientists created electrical fields in their laboratory that were similar to those produced by storms, and then introduced insects, including stinkbugs and spruce budworms, into them to see if the insects could be set aglow. The bugs consistently displayed colored flares from their external points—antennae, leg joints, and jaws.

Forest Service records show that severe spruce budworm infestations were present in forests near Roosevelt, Utah, just before the UFO sightings. According to Callahan and Mankin's theory, the budworm moths were probably migrating at night in swarms when they were trapped in atmospheric electrical fields.

Minister Marchand Cites CANUSA Program At CIF-SAF Meeting

In his keynote speech to the joint CIF-SAF meeting in St. Louis, Mo., on October 23, Canadian Minister of the Environment, the Hon. Len Marchand, cited the CANUSA Program as being an important first as a cooperative joint planning and research attack on a problem common to both our countries. He said, "Working together in this way is an exciting forestry first in North America. I wish to congratulate the two groups of people responsible; initially those who had the vision and perception to view a joint program as an opportunity, and then to develop a workable agreement, and now all those people on both sides of the border who are making CANUSA work."

This CANUSA Program is looked to by foresters in both countries as a possible forerunner of future cooperative efforts.

Eastern Spruce Budworm Research Task Force

The task force for the review of CFS eastern spruce budworm research has completed the first two phases of its program—meetings with representatives from the six eastern provinces and industry. Meetings were held in Toronto, Fredericton, Quebec City, St. John's, Halifax and Charlottetown during October and November, 1978, in an attempt to determine how the budworm/forest problem affects forest management in each province.

The results of these meetings were reviewed and a number of research goals identified. The next step was to present these goals, and the rationale of how they were arrived at, to CFS scientists for their comments and discussion. Meetings were held as follows: Newfoundland Forest Research Centre, Jan. 9: Laurentian Forest Research Centre, Jan. 16: Maritimes Forest Research Centre, Jan. 22: Great Lakes Forest Research Centre and Forest Pest Management Institute, Jan. 30. Allowance was made for the meetings to extend over several days if necessary.

International Inventory

A complete inventory of all Program-related research and development on the spruce budworms, in Canada and the USA—that's the outside task taken on by Mel McKnight (U.S. Program Leader). The full cooperation of investigators in Canada and the USA will be needed to make the inventory reasonably complete and useful. When the inventory is completed you will be able to find out where and what R & D work of special interest to you is being done and by whom. *That's* what all those nice, neat stacks of paper are in Mel's office.

Meetings

a) *Joint Planning Unit Meeting*

The Eastern (U.S.) Component hosted the fourth meeting of the CANUSA Program's Joint Planning Unit (JPU) at Greenville, Me., on August 29-30, 1978. The first day was spent in joint session. The second day, the Maine Forest Service arranged for an overflight of budworm infestations near Baxter State Park, and the Northeastern Forest Experiment Station provided an informative visit to study plots in the area.

During the joint session, the U.S. and Canadian contingents presented highlights of budworm R & D efforts of the 1978 season and plans for 1979. Areas in which Eastern U.S. efforts are likely to be limited and Canadian strength is needed are (1) evaluation of chemical and microbial pesticides, and (2) development of pheromones for control. The Eastern U.S. Program will be looking to Canada to provide leadership in these two areas with the U.S. participating where feasible and appropriate. These preliminary discussions at the JPU meeting are likely to lead to a joint U.S.-Canadian evaluation of a control material, probably *Bacillus thuringiensis*, in 1979.

b) *Eastern Spruce Budworm Research Work Conference*

The third annual work conference will be held in Bangor, Me., February 27, 1979. For details contact J.B. Dimond, 312 Deering Hall, University of Maine, Orono, Me., 04473, or call (207) 581-7704.

c) *Egg Mass Task Force*

The FI & DM-Methods Application Group (MAG) of USDA Forest Service sponsored the yearly meeting of the task force on spruce budworm egg mass sampling. The meeting was in Davis, Calif., on November 1 and 2, 1978. The task force's purpose is to standardize survey techniques and to improve the reliability of predictions.

Tom Flavell (Western Program) discussed integrating the egg mass/defoliation measurement system with Program work. An audience of Canadian and American investigators and Regional FI & DM Staff attended.

d) *The Sixth Annual Forest Pest Control Forum*

Fifty six representatives from provincial, state and federal governments, universities and the forest industry attended the Sixth Annual Forest Pest Control Forum in Ottawa, November 28 and 29, 1978. The purpose of the forum is to discuss current and proposed forest pest control operations and research bearing on forest pest control. Although the forum functions on the initiative of the Canadian Forestry Service and is concerned about forest protection, it is appreciated that control operations can affect other segments of the environment and these are given consideration during deliberations.

Most of the discussions dealt with the spruce budworm because of the magnitude of the control programs in eastern Canada and the United States. During the meeting Mel McKnight, Dan Schmitt and Charlie Miller reviewed the progress of the CANUSA Program in 1978 and outlined future plans.

e) *B.t. Meetings*

On October 24 and 25, 1978, researchers from the Canadian Forestry Service (CFS) and the Quebec Department of Lands and Forests met to discuss results of research and field trials using *Bacillus thuringiensis* to control the spruce budworm during 1978. As a result of this meeting a CFS policy statement for the use of B.t. in 1979 was formulated listing recommendations for minimum application specifications, and standards for monitoring B.t. applications and their effects on budworms, host trees, and forest stands.

A seminar on the use of B.t. for the control of spruce budworm was held on November 30 for provincial authorities and other agencies interested in experimental or operational trials with B.t. in 1979. Attempts were made to promote joint planning with CFS and to develop a coordinated CANUSA approach.

Dr. Ozzie Morris, Forest Pest Management Institute, Sault Ste. Marie, Ontario, has been appointed to coordinate research and operational tests using B.t. in Canada and to work with scientists in the United States to develop a coordinated program for the use of B.t. against the spruce budworm. A meeting with Canadian and American scientists on the use of B.t. has been planned for late January.

Action Line

Mel McKnight (U.S. Program Leader), Jim Colbert (Research Coordinator-West), and Max McFadden (Program Manager-West) read papers on integrated pest management at a technical session of the Entomology Working Group of the Society of American Foresters on October 24 in St. Louis. Bob Talerico (Research Coordinator-East) was session moderator.

During the CIF-SAF meeting, Jim Colbert organized a meeting of American and Canadian investigators to coordinate modeling efforts on western spruce budworm.

Max McFadden addressed the California Pest Action Council on November 6 in Sacramento, Calif., and the Western Forestry and Conservation Association on December 5.

Dan Schmitt (Program Manager-East) continues his participation in the task force review of spruce budworm research in the Canadian Forestry Service.

Dr. O.N. Morris, Forest Pest Management Institute, Sault Ste. Marie, has been appointed Canadian Coordinator for 1979 B.t. trials.

New Contacts

Art Gittins, from the University of Idaho, will provide the USDA Science and Education Administration, Cooperative Research liaison to the Western U.S. Program. Representing the Association of State College and University Forestry Research Organizations (ASCUFRO) on the Joint Planning Unit (JPU) it's Jay Hughes (Colorado State University), and on the Joint Policy and Program Council (JPPC) Fred Knight (University of Maine).

New Phone Numbers

The Western U.S. Component has new telephone numbers:

Commercial (503) 231-2034

FTS 429-2034

Also, the Eastern U.S. Component:

Commercial (215) 596-1607

FTS 596-1607

Publications

A tome from the Forest Service Northern Region was issued in March with the wonderfully long title *Western Spruce Budworm — A Pilot Control Project with Carbaryl and Trichlorfon, 1975 (Environmental monitoring of aquatic organisms, birds, and insect pollinators)*. The report (No. 78-5) deals with pesticide testing on the Beaverhead National Forest, Mont., and is available from USDA Forest Service, Northern Region, Missoula, Mont.

Let's Cheer Him On

Charles Buckner, Canadian Program Leader, suffered a heart attack in early October. Fortunately, he is doing quite well and his health is improving.

. . . MEANWHILE, Charles A. Miller, Maritimes Forestry Research Centre, Fredericton, has been designated as Acting Program Leader-Canada. Charlie can be reached at (506) 452-3500.